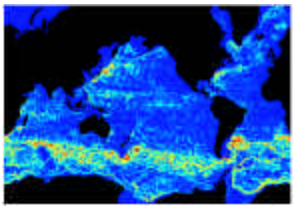
Office of Science

Biological and Environmental Research

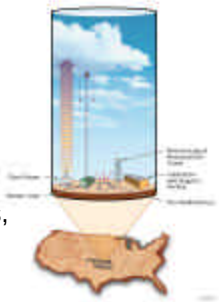
http://www.sc.doe.gov/ober/ober_top.html

The Opportunity: With the 21st Century dawns what many have called the "biological century" – when advances in biology will impact our health, our environment and, together with our ability to predict climate over decades to centuries, our responses to global change. The **Biological and Environmental Research** (BER) program, in coordination with other agencies, supports basic, peer-reviewed research at national laboratories and universities across a remarkable breadth of scientific fields from global change to environmental remediation to genomics, proteomics and medicine.

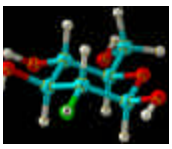


Climate modeling

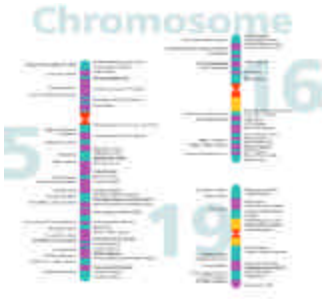
The Challenge: Scientific uncertainties limit our ability to solve many of the health and environmental challenges facing our Nation. The BER program seeks innovative solutions to many of these key scientific challenges. *Global Change Research* – Advanced climate models are needed to describe and predict the individual roles of oceans, the atmosphere, ice, and land masses on climate over time. The role of clouds in controlling solar and thermal radiation into and away from the Earth's atmosphere-ocean system needs to be understood as the single largest uncertainty in climate prediction. The impacts of excess carbon dioxide in the atmosphere from human sources, including energy use, on the Earth's climate and ecosystems need to be understood and possible mitigation strategies developed. *Environmental Research* – Safer, more cost-effective strategies for cleaning up contaminated environments, Including bioremediation are needed. *Medical Research* - Current developments in imaging technology have the potential to revolutionize all of medical imaging. *Biological Research* - Faster, cheaper and more accurate DNA sequencing technology can become one of the most cost effective and efficient tools for discovery in biology and medicine. Computational tools and research strategies for understanding complex biological systems are needed that capitalize on the wealth of DNA sequence information now available as a result of successes in genomics research. New capabilities in genomics and advanced instrumentation make it possible to directly determine the biological effects of low doses of radiation, effects that were previously only estimated from effects induced by high doses of radiation.



Cloud research



Medical imaging



Human Genome Project

Continued

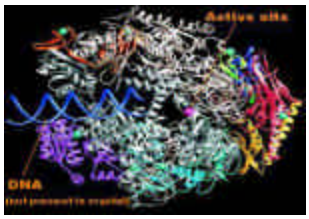
FY 2002 Investment Plan: In FY 2002 BER will support:

- Structural biology research and infrastructure development for structural genomics.
- Human genome research to speed understanding of human gene function and regulation.
- "Genomes to Life" using DOE capabilities in genomics, structural biology, imaging, computation, and engineering to explore the function, diversity and regulation of the multiprotein molecular machines that give life to an organism's genome.
- Research to develop a broad understanding of microbes important to DOE missions by studying genomic DNA sequences, microbial gene function and specific biochemical pathways.
- Leveraging advances in genomics and instrumentation to detect and characterize the biological effects of low doses of radiation.
- Continued development of advanced capabilities to predict climate on global and regional scales, exploration of carbon cycle and aerosols' impact on climate, investigation of carbon sequestration and studies of the potential impacts of climate change.
- Bioremediation research, including field programs, and operation of the Environmental Molecular Sciences Laboratory to address environmental contamination at DOE sites.
- Innovative technology research to image single molecules, genes, cells, organs, and whole organisms in real time under natural physiological conditions.

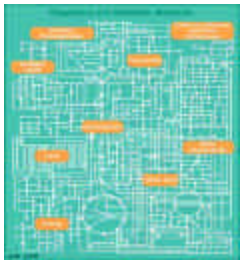
The Benefit:

Basic biological and environmental research has broad impacts on our health and our environment. Effective planning for future needs in energy, agricultural and land and water use is enabled by an ability to predict climate on a range of time and space scales. Biological solutions are possible for many of DOE's energy and environmental challenges by understanding complex biological systems and developing computational tools to model and predict the behavior of those systems. Understanding global carbon cycles and how microbes in the terrestrial and ocean systems can lead to solutions for reducing the terrestial and ocean systems can lead to solutions for reducing the impact of excess carbon dioxide on global warming. Biological methods can be developed to help clean up metals and radionuclides contaminating former DOE weapons sites. Basic research also leads to improvements in and better protection of human health. Both normal and abnormal health –- from human development to cancer to brain function – can be understood using radiotracers and advanced imaging instruments. Understanding the biological effects of low doses of radiation can lead to the development of science-based health risk policy to better protect workers and citizens.

Environmental Molecular Sciences Laboratory



Structural biology



Modeling biological pathways